CLANTON & ASSOCIATES

LIGHTING DESIGN AND ENGINEERING

6.3

DNR Green Office Building

Lighting Design

Schematic Design Narrative

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SUSTAINABLE LIGHTING DESIGN

The lighting system should provide excellent visibility for people, working, conversing, and way-finding in the building. Fundamentals of the lighting design philosophy incorporate a quality visual environment that is flexible for the users and that is integrated in the total building and systems design. Specific design goals for the design process are detailed below.

Provide direct/indirect electric lighting for comfortable working environments in the library, conference rooms and offices.

Direct/indirect lighting can create a comfortable work environment. Because the light source presents very low brightness and the ceiling brightness is uniform, the system eliminates glare. This is especially important for viewing computer screens. Indirect lighting can also reduce eyestrain and fatigue because this lighting approach provides a diffuse light with no harsh shadows. A small direct component provides lighting balance within the space making reading and writing tasks very comfortable.

Since daylight will not penetrate the entirety of all areas, direct/indirect electric lighting fills in the gaps to blend in with the daylight. When controlled with a dimming system, this type of lighting easily accommodates changes in available daylight while still providing uniform ceiling brightness.

Increase lighting levels with task lighting for individual tasks.

The most efficient method for increasing lighting levels for tasks is to provide specialized task lighting. Therefore, task lighting may be specified in office work areas and over countertops. Task lighting maximizes visibility for task work while saving energy by allowing ambient light levels to be lower. Task lighting can easily be controlled with occupancy sensor power plug strips, designed for computer surge protection. In this way, when no one is in the work area, task lights, computer monitors and other non-essential equipment can be turned off.

Use energy effective and low maintenance equipment

Since equipment maintenance is an important concern, lighting equipment should be reliable. This includes lamps, ballasts, and controls. Suggestions in decreasing maintenance include long warranties for parts and labor, specifying equipment from reliable manufacturers with good track records, and minimizing the amount and type of equipment. In addition, lamp selection should be based on efficacy (lumens per watt), color temperature, color rendering index, life, availability, dimming capability and cost.

- T8 and T5 linear fluorescent, compact fluorescent, and inductive lamps may be options for interior spaces.
- High frequency electronic ballasts are also important to visual performance and reducing fatigue. Frequencies in the 25K+ range will provide smooth, non-flickering operation.
- Luminaires will be selected for their lighting effectiveness. This includes distribution characteristics, efficiency, quality construction, aesthetics, and economics.
- Controls will provide occupants with lighting flexibility in their spaces, utilize daylight, and reduce lighting loads when a space is unoccupied.
- The equipment selection will minimize the required maintenance. The number of luminaire and lamp types will be minimized. All luminaires will be easily accessible for re-lamping. All lamps specified will have a long life to minimize re-lampings.

Provide individual lighting control to private areas such as offices and conference rooms

Provide individual dimming control in all of the open office areas. This can be accomplished with personalized dimming controls for the ambient lighting in close proximity of each work station. Not only will the occupants appreciate the flexibility in lighting levels, but reduced energy use and extended equipment life will provide desirable life cycle cost savings.

Also, wall or ceiling-mounted occupancy sensors may control private offices and conference rooms. Dimming switches will also be provided in each room for user-friendly control capability.

Utilize daylighting as the primary lighting source whenever possible.

The electric lighting control systems will maximize all energy-savings potential from daylighting.

During the day, lobbies, reception areas, corridors, and break areas are daylighted. All of the spaces along the perimeter of the building and areas beneath toplighting systems receive varying amounts of sunlight throughout the day. When a space is not receiving sunlight directly, direct/indirect electric lighting helps to illuminate the space.

To accommodate the varying amounts daylight in a public or multiple-user space, luminaires in these spaces, may be controlled with an automatic dimming system. This will allow daylight sensors to respond to small changes in daylight without distracting the occupants with sudden lighting changes.

In other areas, "window-side" luminaires may be controlled separately so they may be turned off completely when daylight provides adequate illuminance for that portion of the room.

Turn the lights off when spaces are unoccupied.

The greatest energy benefit from electric lighting is to turn lights off in vacated spaces. Motion sensors will accomplish this in a safe manner with sensor redundancy and overlapping of sensor coverage areas. In general, lighting loads can be reduced up to 50% through the use of occupancy sensors. This will include circulation areas where luminaires will be turned on ahead of an occupant at night. This strategy provides illuminance where needed, while never requiring the occupant to walk into a dark space.

Luminaires in private offices will be switched off when the space is not occupied. In open workstation areas, luminaires may be automatically dimmed rather than switched off over an unoccupied workstation. This will save energy when it is not required without creating a dark gap in the uniform ceiling brightness. If all workstations in an area are unoccupied, then the group of luminaires may be switched off. The occupancy sensors may also include a daylight override capability where appropriate.

Restrooms will be controlled solely by ceiling-mounted ultrasonic occupancy sensors, which are the best choice for rooms with high partitions.

Light specific areas and events individually.

Instead of lighting the entire building in the same manner, each individual area will be lighted according to its use and character. The result is lighting that is individualized to users' specific needs. Listed below are specific examples for each area.

Office and conference rooms

Reading, conversing and computer work occur in the offices. Direct/indirect fluorescent pendants will provide comfortable general ambient lighting. Fluorescent task lighting should be provided for extra illumination for those who need it.

Conference rooms are lighted in a similar manner, with the addition of linear fluorescent or compact fluorescent wall washing to light wall displays.

Manually dimming the fluorescent pendant will give individuals control over the general lighting system. Occupancy controls will turn off the lights when no one is in the room.

Lobby, reception and general main circulation

Light surfaces in the general circulation area for a comfortable atmosphere.
Typically, lobbies are lighted with powerful overhead lighting that is aimed straight down. This type of lighting directs the light through the volume of the space in an inefficient manner. Also, with luminaries mounted in a high ceiling, maintenance is extremely difficult.

One approach involves lighting surfaces; with luminaires in accessible locations near the surfaces they are illuminating. If pendants are used in an atrium or stairway, the length will allow the fixture to be pulled to one side for maintenance and re-lamping. Another option for lighting may involve using wall mounted indirect sconces to light the ceiling. Additional decorative wall sconces located in elevator lobbies and other key circulation areas will bring light at a pedestrian level.

Occupancy sensors can control the lighting. If daylight is available, then sensors can turn off the light when daylight is plentiful.

Break Areas

The style of luminaire and light levels should be appropriate for an inviting and relaxing space. Decorative ceiling mounted compact fluorescent luminaires may be located in each low ceiling bay. Select wall washing will brighten the walls.

Occupancy sensors can control the lighting. If daylight is available, then sensors can turn off the light when daylight is plentiful.

Library

In the stack area, pendant mounted direct/indirect luminaires will evenly light the books. Installing the luminaires perpendicular to the stacks will allow less dependency on stack locations. The stack lights can be controlled with occupancy sensors that will be most effective during the late evening and night hours.

Daylight dimming and occupancy controls will further reduce the electrical load.

Corridors

The lighting system for the general circulation areas should aide the occupants in wayfinding and general orientation. If the walls and ceilings are lighted, the circulation will feel wide open and larger.

If the corridor ceilings are low (8'6" and below), then a recess "indirect" fluorescent luminaire could provide the circulation brightness. Another alternative may be to light the corridors with linear wall washing such that the walls are highlighted. Compact fluorescent wall sconces may be added at restroom entrances and elevator lobbies.

Occupancy sensors can control the corridor lighting. If daylight is available, then sensors can turn off the light when daylight is plentiful.

Restrooms

Restrooms require lighting over the vanities, sinks, stalls, and urinals. A continuous fluorescent wall slot will provide low glare lighting over these areas. If the restrooms are large, then additional recessed compact fluorescent downlights may be needed at the entry areas and in the middle of the restrooms. All lighting will be controlled with occupancy sensors.

Exterior Lighting

Environmentally sensitive lighting includes minimizing light trespass and light pollution, as well as using minimal energy with the lighting equipment operation. Luminaires without optical control may throw light into adjacent properties or woodland areas (light trespass) or into the atmosphere (light pollution). Cut-off optics allow more control of the light with no uplight component to avoid light trespass and prevent light pollution.

Lighting in the parking lot should provide uniform lighting to enhance safety and security. White light will provide the best visibility for seeing details and for detecting peripheral activity. Ideally, induction lamps are excellent lamp sources for the parking lot area because of the instant "on" capability. This would allow the electric lighting to be controlled with occupancy sensors, especially in the late evening and night hours when there is little activity in the parking lot. Metal halide lamps would be a white light alternative, but could not be controlled by motion sensors.

Lighting around the building should be limited to entry and pedestrian areas. Compact fluorescent wall sconces can effectively light entry areas. If pedestrian walks are not adjacent to the building, then compact fluorescent or induction lamp pedestrian lights may be used. Motion sensors can easily control this lighting to save a maximum amount of energy and preserve the dark skies.

Energy Efficiency and Goals

The first step in an energy-efficient lighting design is to create a comfortable environment with high visibility and an efficient placement of the lighting equipment. Additionally, the following aspects of the design will improve the efficiency of the lighting system:

- Daylight will replace electric light when available. Sensors will dim or turn off luminaires when daylight adequately illuminates a space.
- Interior surface reflectance values will be maximized. Less light is required when surface reflectances are high.
- Energy-efficient lamps, ballasts, and luminaires will be specified.
- Occupancy sensors will provide light only when a space or area is in use.
- Occupant control will minimize lighting loads.
- Lower peak lighting loads will be used to size mechanical equipment.
- Commissioning of the lighting and controls and owner training will ensure that the energy-efficient design keeps functioning the way it is designed.
- Connected load goals should be 1.0 watt per square foot. With daylight and occupancy controls, the peak condition could be 50% of this load.